

# Platelet Additive Solution with and without Citrate for Pathogen-Reduced Platelets to Improve Platelet Storage Properties



**American Red Cross**

Cheryl A Hapip, Dedeene Thompson-Montgomery, Erin Fisher, Annette Turgeon, Stephen J Wagner, PhD, Todd Getz\*, PhD and Bethany L Brown, PhD, MSCS  
Transfusion Innovation Department, American Red Cross Holland Laboratory, Rockville, MD

## Background & Objectives

Citrate in PAS may cause apoptosis and contribute to platelet storage lesions. Removing citrate from PAS has demonstrated reduced anaerobic glycolysis, spontaneous P-selectin expression, phosphatidylserine (PS) exposure and reactive oxygen species (ROS) formation in vitro (Getz et al., Transfusion. 2019). This study evaluates the in vitro storage properties of pathogen-reduced apheresis platelets in PAS-III and PAS-III without citrate (Fixsol).

## Study Design

12 hyperconcentrated double Amicus platelets with 200 mL concurrent plasma were collected from normal, consenting research donors. The unit was immediately divided into two units of equal weight and either PAS-III or Fixsol solutions were added to achieve a plasma concentration of 35%. After a rest period of 1 to 4 hours, the units were stored overnight on an agitator at 20–24 °C. Each unit was treated with the INTERCEPT™ pathogen reduction system within 24 hours of collection using the INTERCEPT™ SV processing kits. Following incubation with the compound adsorption device (CAD), the units were transferred to the storage container and stored on an agitator at 20-24°C. Platelet parameters were measured at Day 1 (prior to pathogen reduction) and on Days 5 and 7.

## Results

Day 5 and Day 7 in vitro results are summarized in the Table. The glucose concentration and pH progressively decreased, while the lactate production increased during storage in both units. However, the glucose concentration and pH were higher in the Fixsol PLT, and the lactate was lower in the Fixsol PLT compared to the PAS-III PLT ( $p < .001$ ). The pH remained within normal range throughout storage. Phosphatidylserine, P-selectin levels and ROS formation were decreased in the Fixsol PLT ( $p < .05$ ). In addition, the hypotonic shock response and extent of shape change values were greater in PLTs stored in Fixsol ( $p < .001$ ).

## Conclusion

Storage of pathogen-reduced apheresis platelets in Fixsol reduces platelet storage lesion by decreasing glucose consumption, spontaneous activation, and apoptosis in PLT.

Assay	Additive Soln	Day 5*	Day 7*
pH (RT)	PAS-III	6.90 ± 0.06	6.76 ± 0.08
	Fixsol	7.06 ± 0.05	6.93 ± 0.10
Glucose (mM)	PAS-III	2.43 ± 0.60	0.89 ± 0.41
	Fixsol	3.78 ± 0.63	2.10 ± 0.83
Lactate (mM)	PAS-III	9.26 ± 1.16	12.16 ± 1.11
	Fixsol	7.04 ± 1.02	10.05 ± 1.57
HSR (%)	PAS-III	34.1 ± 12.6	20.1 ± 10.0
	Fixsol	48.8 ± 10.3	38.9 ± 13.2
ESC (%)	PAS-III	8.1 ± 3.7	6.1 ± 3.4
	Fixsol	15.0 ± 5.2	10.6 ± 4.5
ISOA (DHE) (%)	PAS III	10.6 ± 1.5	15.9 ± 4.0
	Fixsol	6.9 ± 1.5	10.2 ± 2.2
JC-1	PAS-III	50.4 ± 8.8	31.2 ± 6.1
	Fixsol	63.1 ± 7.5	47.3 ± 10.8
H <sub>2</sub> O <sub>2</sub> (Mean FL1)	PAS-III	1627 ± 374	3273 ± 2684 <sup>†</sup>
	Fixsol	771 ± 237	1276 ± 888 <sup>†</sup>
CD62P	PAS-III	67.6 ± 5.5	72.1 ± 6.0
	Fixsol	54.2 ± 8.3	62.9 ± 5.9
Annexin V	PAS-III	23.7 ± 8.3	28.5 ± 7.7
	Fixsol	15.1 ± 9.4	18.1 ± 9.5
CD42b	PAS-III	4369 ± 525	3670 ± 502
	Fixsol	4724 ± 617	4261 ± 640
* $p \leq 0.001$ for all parameters			
† $p < 0.05$			

\*T. Getz was an employee of American Red Cross and is now an employee of the U.S Army Medical Research and Development Command